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10/723,219	11/26/2003	Hideki Tsuchida	51880	5528

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EXAMINER

WONG, EDNA

ART UNIT PAPER NUMBER

1753

DATE MAILED: 02/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/723,219

Applicant(s)

TSUCHIDA ET AL.

Examiner

Edna Wong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-8 is/are rejected.
- 7) ☒ Claim(s) 4 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date October 27, 2004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

***Priority***

Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Japan on November 28, 2002. It is noted, however, that applicant has not filed a certified copy of the 2002-345430 application as required by 35 U.S.C. 119(b).

***Claim Rejections - 35 USC § 112***

Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2

lines 11-15, if "X is chosen from a hydrogen atom, an alkyl group containing 1-10 carbon atoms, an aryl group, a linear or cyclic amino group containing 1-6 nitrogen atoms, 1-20 carbon atoms, and multiple hydrogen atoms, or a hetero cyclic group containing 1-2 sulfur atoms, 1-6 nitrogen atoms, 1-20 carbon atoms, and multiple hydrogen atoms", then the compounds of formulas (1) to (8) should be defining "Y".

lines 11-15, in "X is chosen from a hydrogen atom, an alkyl group containing 1-10 carbon atoms, an aryl group, a linear or cyclic amino group containing 1-6 nitrogen atoms, 1-20 carbon atoms, and multiple hydrogen atoms, or a hetero cyclic group containing 1-2 sulfur atoms, 1-6 nitrogen atoms, 1-20 carbon atoms, and multiple

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hydrogen atoms", the scope of the species defining X is unclear.

For example, are the "1-20 carbon atoms" defining "X" or further defining the linear or cyclic amino group containing 1-6 nitrogen atoms?

lines 11-15, the definition of "A" is missing.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims **1-3 and 5-7** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Belongia et al.** (US Patent No. 6,391,209 B1) in combination with **Barstad et al.** (US Patent No. 6,444,110 B2).

Belongia teaches a method for electrolytic copper plating on a substrate comprising the steps of:

- (a) providing an electrolytic copper plating solution (= spent electroplating bath),
- and
- (b) contacting the electrolytic copper plating solution (= spent electroplating bath) with ozone (col. 7, lines 22-37) [col. 5, line 60 to col. 6, line 8; col. 6, lines 22-35; and Fig. 1].

The substrate is chosen from a printed circuit board and a wafer (= semiconductor wafer surfaces) [col. 5, lines 60-65].

The method further comprises the steps of contacting the substrate with the electrolytic copper plating solution and applying sufficient current density to deposit copper on the substrate (= the treated solution is recycled back to the electroplating process) [col. 4, lines 63-67].

Belongia does not teach wherein the electrolytic copper plating solution comprises a compound comprising the formula of -X-S-Y-, wherein X and Y are independently chosen from hydrogen atom, carbon atom, sulfur atom, nitrogen atom, and oxygen atom, and X and Y may be the same only when they are a carbon atom.

However, Barstad teaches that typical brighteners contain one or more sulfur atoms and generally comprise the formula  $R'-S-R-SO_3X$ , wherein R is an optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl group, or optionally substituted heteroalicyclic; X is a counter ion such as sodium or potassium; and R' is hydrogen or a chemical bond (i.e., -S-R-SO<sub>3</sub>X or substituent of a larger compound) [col. 5, lines 3-67].

Thus, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of

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Belongia with wherein the electrolytic copper plating solution comprises a compound comprising the formula of  $-X-S-Y-$ , wherein X and Y are independently chosen from hydrogen atom, carbon atom, sulfur atom, nitrogen atom, and oxygen atom, and X and Y may be the same only when they are a carbon atom because Belongia teaches that the electroplating baths used in the semiconductor industry. Such baths generally contain one or more brighteners (col. 5, line 60 to col. 6, line 8).

Barstad teaches electroplating baths used in the semiconductor industry (col. 1, line 15 to col. 2, line 42; and col. 7, lines 56-65), and that typical brighteners generally comprise the formula  $R'-S-R-SO_3X$ , wherein R is an optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl group, or optionally substituted heteroalicyclic; X is a counter ion such as sodium or potassium; and R' is hydrogen or a chemical bond (i.e.,  $-S-R-SO_3X$  or substituent of a larger compound) [col. 5, lines 3-67].

Thus, a compound comprising the formula of  $-X-S-Y-$ , wherein X and Y are independently chosen from hydrogen atom, carbon atom, sulfur atom, nitrogen atom, and oxygen atom, and X and Y may be the same only when they are a carbon atom would have been an obvious brightener to use in the electroplating baths disclosed by Belongia.

As to wherein the compound comprising the formula  $-X-S-Y-$  is chosen from compounds of formulas (1) to (8)

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- (1)  $M-SO_3-(CH_2)_a-S-(CH_2)_b-SO_3-M$ ;
- (2)  $M-SO_3-(CH_2)_a-O-CH_2-S-CH_2-O-(CH_2)_b-SO_3-M$ ;
- (3)  $M-SO_3-(CH_2)_a-S-S-(CH_2)_b-SO_3-M$ ;
- (4)  $M-SO_3-(CH_2)_a-O-CH_2-S-S-CH_2-O-(CH_2)_b-SO_3-M$ ;
- (5)  $M-SO_3-(CH_2)_a-S-C(=S)-S-(CH_2)_b-SO_3-M$ ;
- (6)  $M-SO_3-(CH_2)_a-O-CH_2-S-C(=S)-S-CH_2-O-(CH_2)_b-SO_3-M$ ;
- (7)  $A-S-(CH_2)_a-SO_3-M$ ; and
- (8)  $A-S-CH_2-O-(CH_2)_a-SO_3-M$ ;

wherein M is chosen from a hydrogen atom and an alkali metal; X is chosen from a hydrogen atom, an alkyl group containing 1-10 carbon atoms, an aryl group, a linear or cyclic amino group containing 1-6 nitrogen atoms, 1-20 carbon atoms, and multiple hydrogen atoms, or a hetero cyclic group containing 1-2 sulfur atoms, 1-6 nitrogen atoms, 1-20 carbon atoms, and multiple hydrogen atoms; and a and b are independently an integer of 3-8, Belongia teaches that useful brighteners include  $XO_3S-R-S-S-R-SO_3X$  wherein R is an optionally substituted alkyl group and X is a suitable counter ion such as sodium or potassium (col. 5, lines 36-49).

As to wherein the compound comprising the formula  $-X-S-Y-$  is present in the electrolytic copper plating solution in the range of 0.1-100 mg/L, Barstad teaches a brightener concentration of from about 20 to about 200 mg/L of plating solution (col. 4, lines 49-61).

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As to wherein the substrate comprises through holes or via holes, **Belongia** teaches semiconductor wafer surfaces (col. 5, lines 64-65). **Barstad** teaches that current and anticipated semiconductor fabrication requirements include microvias having aspect ratios of at least 4:1 and diameters of 200 nm or less (col. 2, lines 45-54).

Thus, through holes or via holes would have been obvious in the semiconductor wafer surfaces as taught by **Barstad** (col. 2, lines 45-54).

II. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Belongia et al.** (US Patent No. 6,391,209 B1) in combination with **Barstad et al.** (US Patent No. 6,444,110 B2).

**Belongia et al.** and **Barstad et al.** are as applied for the reasons as discussed above and incorporated herein.

#### ***Allowable Subject Matter***

The following is a statement of reasons for the indication of allowable subject matter:

Claim 4 defines over the prior art of record because the prior art does not teach or suggest the method of claim 1 wherein a concentration of a compound comprising a structure of  $-X-S^-$  in the electrolytic copper plating solution is controlled in the range of 1.0  $\mu\text{mol/L}$  or lower.

The prior art does not contain any language that teaches or suggests the above.



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*Belongia et al. and Barstad et al.* do not teach wherein a concentration of a compound comprising a structure of -X-S<sup>-</sup> in the electrolytic copper plating solution is controlled in the range of 1.0 µmol/L or lower. Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a prima facie case of obviousness cannot be established.

Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

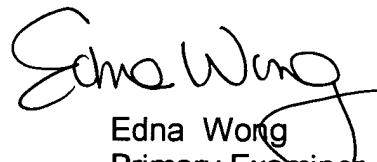
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 3:30 pm, Flex Schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Edna Wong  
Primary Examiner  
Art Unit 1753

EW  
February 9, 2005